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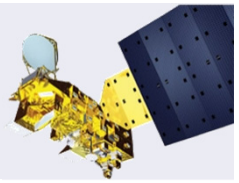


AIRS Project Status and Future Applications

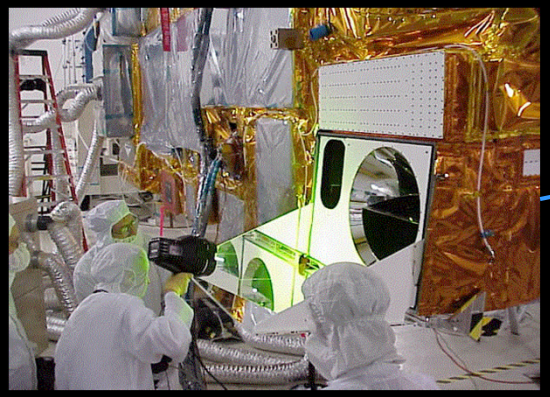
AIRS Science Team Meeting
April 24, 2012

Thomas S. Pagano
California Institute of Technology, Jet Propulsion Laboratory
4800 Oak Grove Drive, Pasadena, CA, USA 91109

tpagano@jpl.nasa.gov, (818) 393-3917, http://airs.jpl.nasa.gov

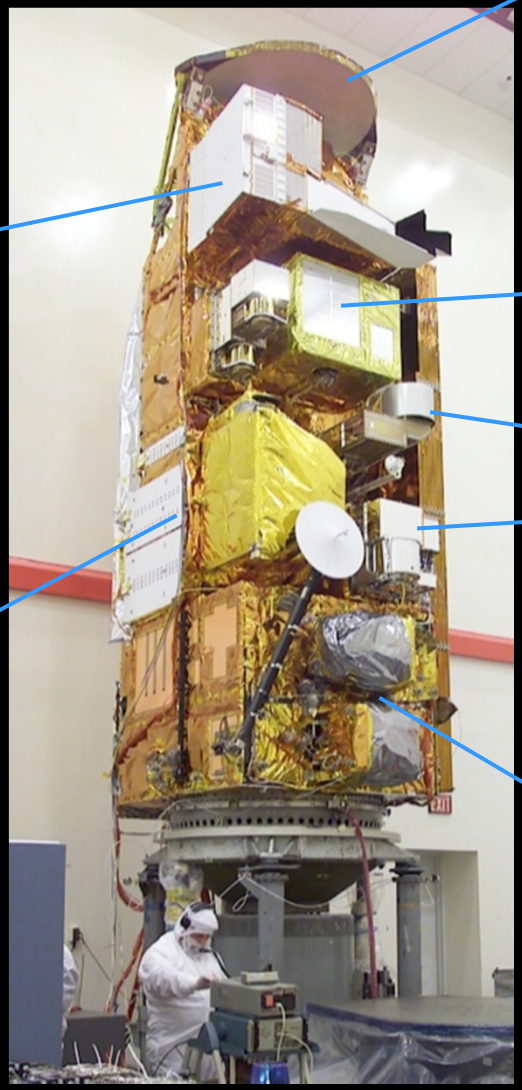
The Aqua Spacecraft

Launched May 4, 2002



Moderate Resolution Imaging Spectroradiometer (MODIS)
GSFC/Raytheon

Atmospheric Infrared Sounder (AIRS)
JPL/BAE SYSTEMS

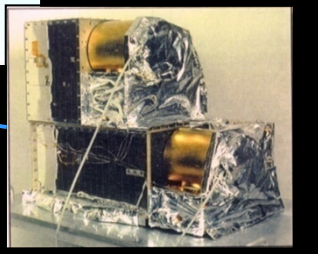


AQUA Spacecraft
GSFC/NGST

Advanced Microwave Scanning Radiometer (AMSR-E)
MSFC/JAXA

Advanced Microwave Sounding Units (AMSU-A/B)
JPL/Aerojet

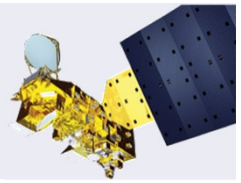
Humidity Sounder from Brazil (HSB)
JPL/Aerojet



Clouds and Earth Radiant Energy System (CERES)
LaRC/NGST

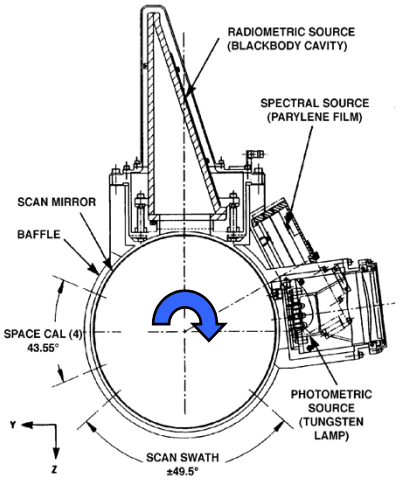
Jet Propulsion Laboratory
California Institute of Technology

AIRS Technology Still Operating Well 10 years after launch!

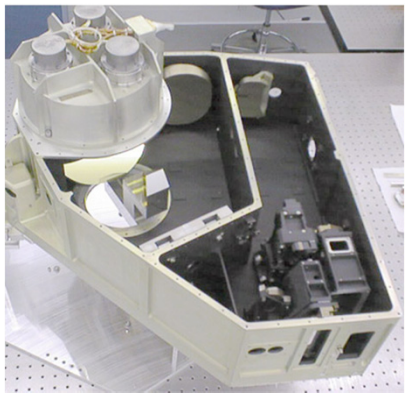


AIRS Features

- Orbit: 705 km, 1:30pm, Sun Synch
- Pupil Imaging IFOV : 1.1° x 0.6° (13.5 km x 7.4 km)
- Scanner Rotates about Optical Axis (Constant AOI on Mirror)
- Full Aperture OBC Blackbody, ε>0.998
- Full Aperture Space View
- Solid State Grating Spectrometer
- Temperature Controlled Spectrometer: 158K
- Actively Cooled FPAs: 60K
- No. Channels: 2378 IR, 4 Vis/NIR
- Mass: 177Kg,
  Power: 256 Watts,
  Life: 5 years (7 years goal)



High Emissivity Blackbody
Constant AOI Scanner
Full Aperture Cal Views

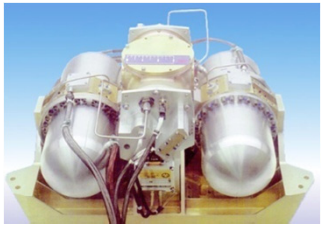


Grating Spectrometer

IR Spectral Range:
3.74-4.61 μm, 6.2-8.22 μm, 8.8-15.4 μm
IR Spectral Resolution:
≈ 1200 (λ/Δλ)
No. IR Channels: 2378 IR

Temperature Controlled Instrument

Instrument to Outlast Spacecraft (2022)



Active Detector Cooling

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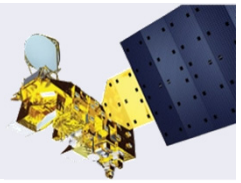
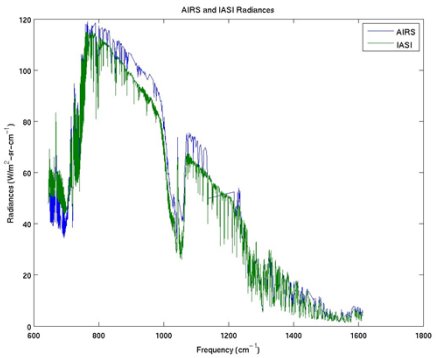
NASA JPL & AIRS Project Support Current Non-NASA Operational Sounders



- IASI on MetOp
  - Intercalibration of Radiances
  - Agreement to better than 50 mK
  - Exceptional stability
  - Exceptional Spectral Resolution (Good Composition Products)



- CrIS on NPP Suomi
  - FTS with similar resolution to AIRS
  - Congratulations on Excellent Checkout
  - JPL PEATE supports NASA NPP Science Team
  - Intercalibration of radiances and products with AIRS to begin at JPL when SDR Checkout Complete

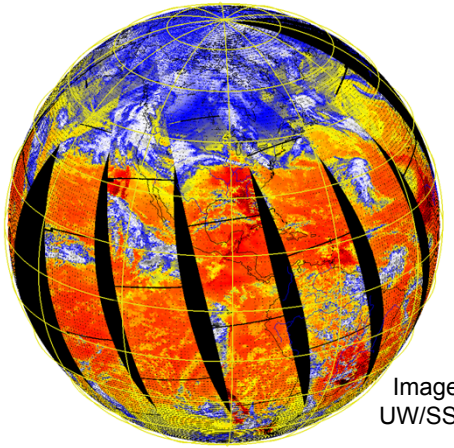
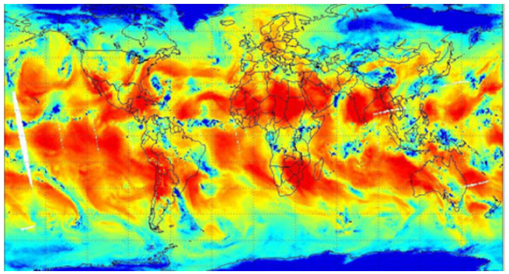


Image by UW/SSEC

- ATMS on NPP Suomi
  - Excellent Checkout
  - Soon to be Commissioned into Operations
  - NPP Science Team (Lambrigtsen, Fishbein)
  - JPL Sounding PEATE



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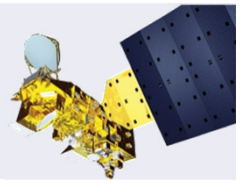
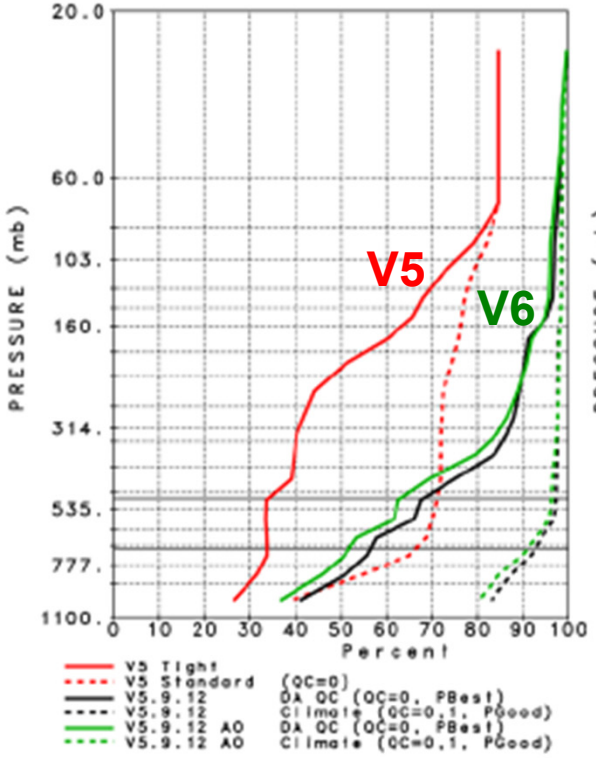
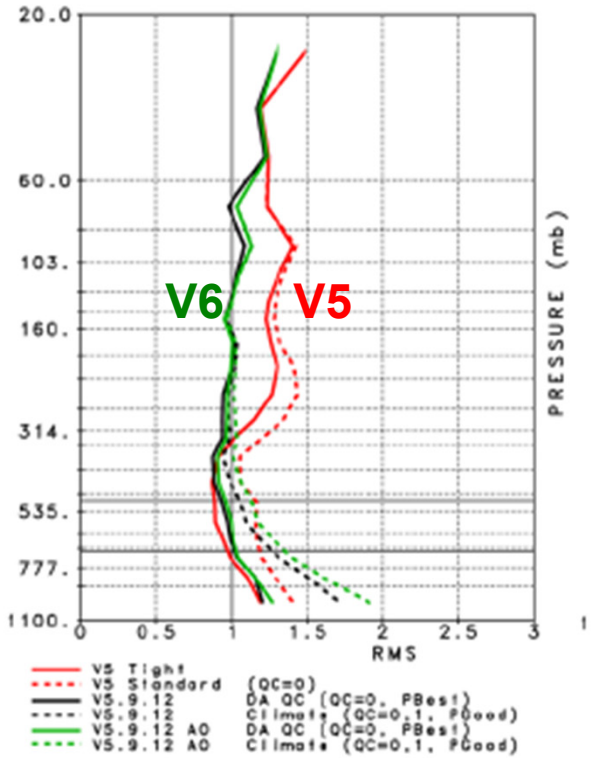
Improvements in AIRS Version 6 Data Products



Higher Yield



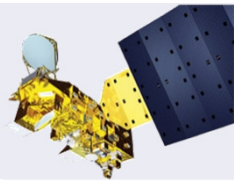
Lower Bias



J. Susskind (GSFC)

- Higher Yield in T, q
- Reduction in UT Biases
- Improved Boundary Layer Sensitivity
- Reduction in Trends
- Improvements Seen in Ancillary Products
  - Cloud Height/Fraction
  - SST
  - CO2 + Other Gases
- New Products
  - Clouds
  - Strat CO2
  - Convective Parameters

Additional Version 6 Test Results to be Shared on Thursday



AIRS Direct Support to Climate and Weather Applications

From Talks Given at AMS Washington Forum 2012:
http://www.ametsoc.org/boardpges/cwce/docs/2012-04/agenda.pdf

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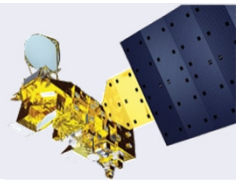
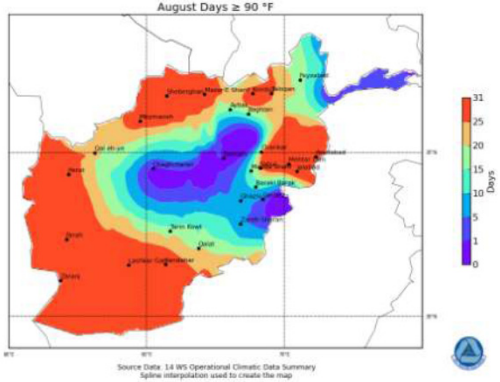
High Demand for Weather Data from US Military



- Cost Guard
  - 24 hrs: Search and Rescue Conditions
  - 7d: Conditions Ideal for Smuggling?
  - Seasonal: Ice Thickness
- Navy
  - Polar Weather, Navigation
  - Climate Change, Bases at Sea Level
  - NRL Monterey R2O Use AIRS Data
- Air Force
  - Climatology of Temperature, Snow Days
  - Winds, Clouds
  - Aerostats Navigation
  - Google Earth Overlay
  - AFWA Norman OK to be testing AIRS Data




Launching a 12Z radio sonde in western Afghanistan


Limited Data Wx Forecasting

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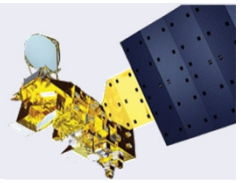
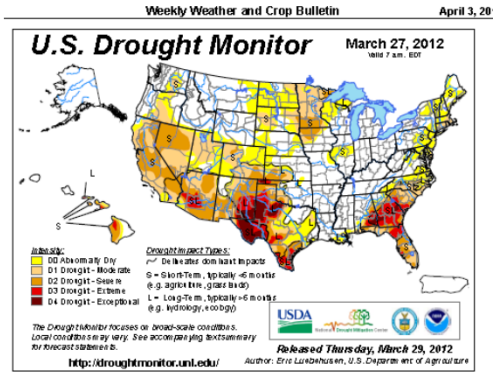
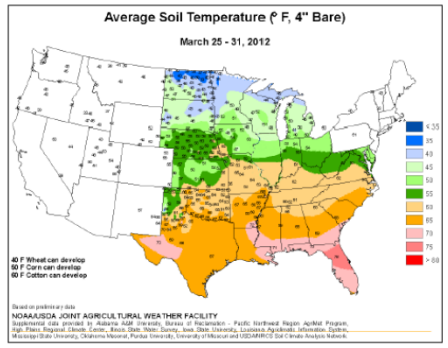
Other National Agencies and International Weather "Desks" Benefit Weather Data



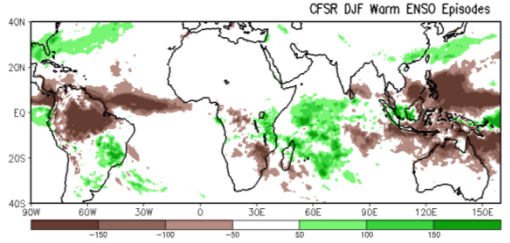
- Example: USDA
  - Data Needs:
  - Water Quantity, Use
  - Soil Moisture, Spatial and Temporal
  - Soil Condition: Tillage, Carbon, Feed
  - Vegetation: Climate Change, Weeds, Enhanced CO2, Invasive Species Mgmt, Plant Condition
  - http://www.ametsoc.org/boardpges/cwce/docs/profiles/ShaferStevenR/2012-04-AWF.pdf
- Example: NOAA NCEP International Desk: Africa
  - http://www.cpc.ncep.noaa.gov/products/african_desk/cpc_intl/
  - ENSO Rainfall Anomalies
  - MJO / Extended Range Forecast: Drought
  - Global Tropical Hazards Outlook: Monsoon Warning
  - Famine Early Warning: FEWS-NET
  - http://www.ametsoc.org/boardpges/cwce/docs/profiles/ThiawWassila/2012-04-AWF.pdf

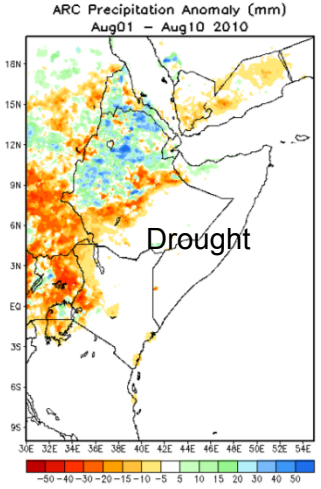


Average Soil Temperature



Rainfall Anomaly





Horn of Africa, 2011
Worst Drought in 60 yrs

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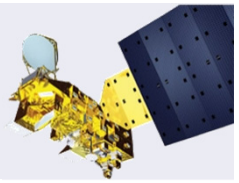
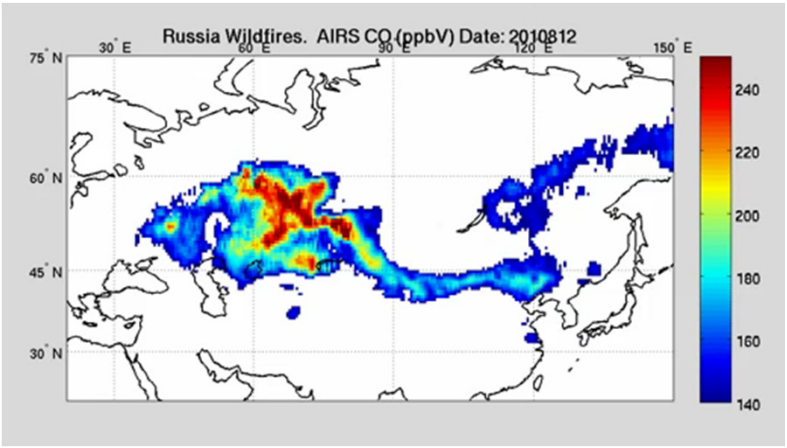
AIRS imagery may be useful to operational agencies and the public. Examples are…

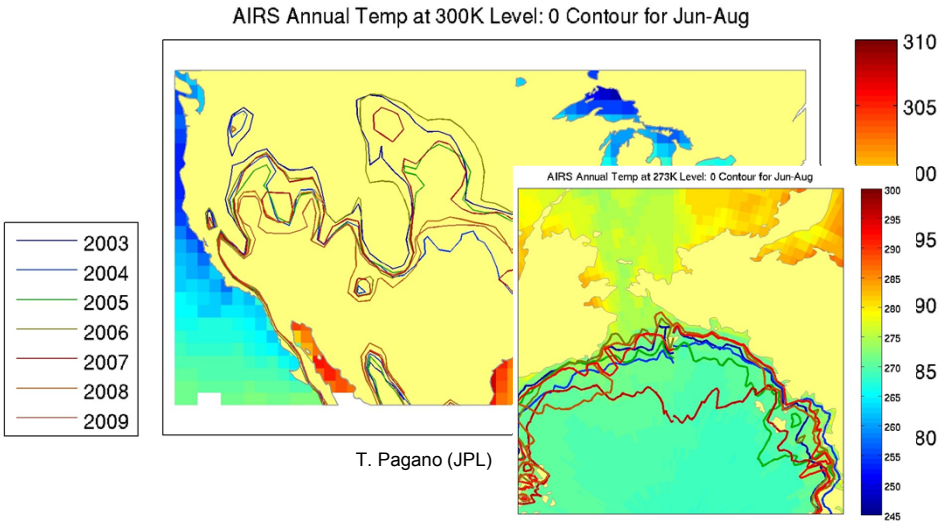


Wildfire CO Maps (Russia 2010)



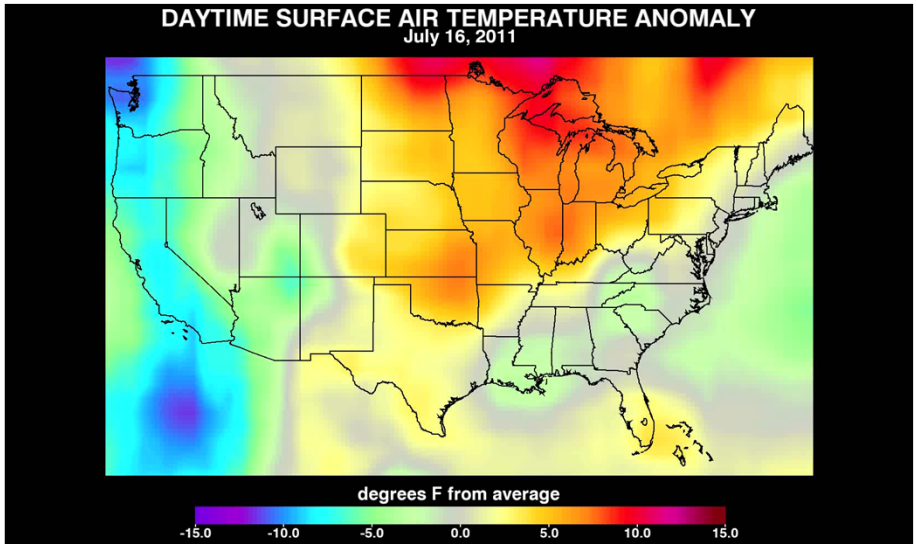
T. Pagano (JPL)

Isotherm Maps (Climatologies US & Arctic)



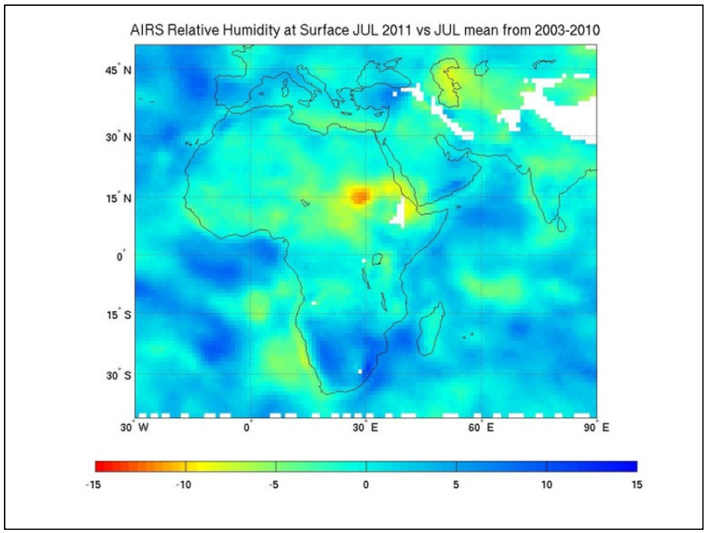
T. Pagano (JPL)

Surface Air Temperature Anomaly (July 2011)



E. Olsen (JPL)

Lower Trop Water Vapor Anomaly (July 2011)



S. Licata / E. Olsen (JPL)

Higher Spatial Resolution is Key to Future Applications (VIIRS Image)

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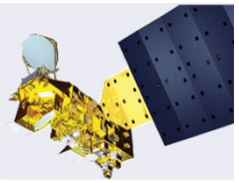
The AIRS Team Remembers
Dr. Moustafa "Mous" T. Chahine: 1935-2011



- **AIRS Science Team Leader: 1988-2011**
- **Developed the Relaxation Method used to derive temperatures and composition profiles on Earth, Mars, Venus and Jupiter**
- **Fellowship in the American Physical Society, American Association for the Advancement of Science, AGU, AMS, and the British Meteorological Societies.**
- **The NASA Exceptional Scientific Achievement Medal (twice 1969, 2007)**
- **The William T. Pecora Award of NASA and the US Department of Interior**
- **The Jule G. Charney Award of the AMS**
- **The Losey Atmospheric Sciences Award of the AIAA**
- **The William Norberg medal from COSPAR**
- **The George W. Goddard Award from SPIE**
- **Developed AIRS Mid-troposphere CO2**
- **Mentor and Friend**
- **Favorite Saying: "Always Make Progress"**

Mous in 1960

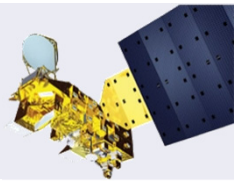
Mous in 2011

Mous and Marina

Mous with son's Tony and Steve and Tony's wife Ruba

Orion Moustafa Chahine, 9/1/11

Summary and Conclusions



- Congratulations on 10 years of Instrument Success. A real Team Effort!
- AIRS experiment successfully demonstrates value of temperature controlled grating spectrometers for stability and accuracy
- AIRS geophysical products widely used for weather forecast improvement, climate process studies (particularly involving hydrothermodynamic processes), and atmospheric composition
- Data products from AIRS greatly improved in V6.
  V6 to be released this summer.
- Support needed to implement AIRS Products for Direct Applications
- Higher spatial resolution needed for future applications.
  What can we do in V7?

- AIRS Data can be found at http://daac.gsfc.nasa.gov
- More information on http://airs.jpl.nasa.gov